LWG
LOWER WILLAMETTE GROUP

SITE-SPECIFIC SQGS BASED ON INDIVIDUAL BIOASSAY ENDPOINTS

DRAFT

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Prepared for
The Lower Willamette Group

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RECOMMENDED FOR INCLUSION IN ADMINISTRATIVE RECORD

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1.0 INTRODUCTION

This technical memorandum provides the site-specific sediment quality guidelines (SQGs) for individual bioassay endpoints derived using the floating percentile model (FPM) and US Environmental Protection Agency (EPA) 2009 toxicity thresholds (Windward 2009b). The memorandum also presents the reliability analyses and maps that show the exceedance areas of the high site-specific SQGs and the non-exceedance areas of the low site-specific SQGs. EPA directed the Lower Willamette Group to provide this information at the benthic risk assessment meeting on January 22, 2010, and later in an e-mail from Eric Blischke (EPA 2010).

2.0 SITE-SPECIFIC SQGS BASED ON INDIVIDUAL ENDPOINTS

The site-specific SQGs based on the high toxicity thresholds and the individual endpoints are presented in Table 2-1. The SQGs necessary to maximize model performance for each endpoint are presented in bold. In order to standardize the list of chemicals across the endpoints, SQGs for non-essential chemicals were retained in each of the four model runs.

Table 2-1. High Site-Specific SQGs for Individual Endpoints

	SQG			
Chemical	**Chironomus Survival**	**Chironomus Biomass**	**Hyalella Survival**	**Hyalella Biomass**
Metals (mg/kg)				
Cadmium	3.51	3.51	**1.61**	3.51
Lead	1,290	**179**	1,290	**365**
Zinc	1,940	**469**	1,940	1,940
PAHs (µg/kg)				
Total LPAHs	**2,300**	**18,000**	**75,000**	**1,600**
SVOCs (µg/kg)				
Carbazole	2,500	**540**	30,000	30,000
Pesticides (µg/kg)				
Total chlordane	669	669	**8.1**	**3.03**
Total DDx	**234**	**218**	**234**	11,500
Conventionals				
Ammonia (mg/kg)	334	**171**	334	334
Sulfide (mg/kg)	**38.5**	**38.5**	**336**	998
Total % fines (%)	100	100	100	**73**
Total organic carbon (%)	**5.54**	**5.54**	13	13

FPM – floating percentile model
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
PAH – polycyclic aromatic hydrocarbon
SQG – sediment quality guideline
SVOC – semivolatile organic compound
Total DDx – sum of all six DDT isomers (2,4′-DDD, 4,4′-DDD, 2,4′-DDE, 4,4′-DDE, 2,4′-DDT, and 4,4′-DDT)

Bold identifies SQGs that are necessary to maximize model performance.

The site-specific SQGs based on the low toxicity thresholds and the individual endpoints are presented in Table 2-2. Similar to the model runs for the high SQGs, a standard list of chemicals was derived for the low SQGs based on all four endpoints. The low SQGs necessary to maximize model performance for each endpoint are presented in bold.

Table 2-2. Low Site-Specific SQGs for Individual Endpoints

	SQG			
Chemical	Chironomus Survival	Chironomus Biomass	Hyalella Survival	Hyalella Biomass
Metals (mg/kg)				
Cadmium	**0.507**	**0.507**	**1.61**	**0.331**
PAHs (µg/kg)				
Total LPAHs	**2,300**	**2,300**	**75,000**	**900**
Pesticides (µg/kg)				
Total chlordane	669	669	**8.1**	669
Total DDx	**234**	**234**	**234**	**26.3**
Conventionals				
Ammonia (mg/kg)	**171**	**171**	334	**117**
Sulfide (mg/kg)	**38.5**	**29.1**	**336**	**11.5**
Total % Fines (%)	**81.9**	100	100	**70.6**
Total organic carbon (%)	**2.7**	**2.7**	13	13

FPM – floating percentile model
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
PAH – polycyclic aromatic hydrocarbon
SQG – sediment quality guideline
SVOC – semivolatile organic compound
Total DDx – sum of all six DDT isomers (2,4′-DDD, 4,4′-DDD, 2,4′-DDE, 4,4′-DDE, 2,4′-DDT, and 4,4′-DDT)
Bold identifies SQGs that are necessary to maximize model performance.

3.0 RELIABILITY ANALYSIS

The reliability analyses for the high site-specific SQGs based on the individual endpoints are presented in Table 3-1. The draft Washington State freshwater guidelines (Avocet 2003) establish goals based on these reliability statistics. Specifically, the goal is for both false negative and false positive rates to be below 20% and the overall reliability to be above 80%. An additional goal is a predicted no-hit reliability greater than 90%, which produces a greater level of confidence when identifying a sampling location as having no adverse effects (Avocet 2003).

All our model runs met these acceptability criteria except for *Hyalella* biomass, which had a false positive rate of 39.37% and an overall reliability rate of 63.48%.

Table 3-1. Reliability Analyses for High Site-Specific SQGs Based on Individual Endpoints

	Endpoint			
Reliability Statistic (%)	Chironomus Survival	Chironomus Biomass	Hyalella Survival	Hyalella Biomass
False negatives	18.75	19.05	15.79	17.95
False positives	13.8	13.6	7.7	39.4
Hit reliability	81.3	81.0	84.2	82.1
No-hit reliability	86.2	86.5	92.3	60.6
Predicted hit reliability	41.9	50.0	43.2	24.2
Predicted no-hit reliability	97.4	96.4	98.8	95.7
Overall reliability	85.7	85.7	91.8	63.5

SQG – sediment quality guideline

Table 3-2 presents the reliability analyses for the low site-specific SQGs based on individual endpoints. Following the methodology used in the draft baseline ecological risk assessment (Windward 2009a), the requirement of < 20% false positive rates was suspended for the low SQGs because the narrative intent[1] for the low SQGs is to reliably predict "clean" areas. Allowing the false positive rate to exceed 20% simply means that low SQGs are conservatively biased to underestimate the total non-toxic area, which is appropriate for screening-level thresholds.

Table 3-2. Reliability Analyses for Low Site-Specific SQGs Based on Individual Endpoints

	Endpoint			
Reliability Statistic (%)	Chironomus Survival	Chironomus Biomass	Hyalella Survival	Hyalella Biomass
False negatives	18.2	19.2	19.0	20.0
False positives	33.7	25.7	7.4	58.7
Hit reliability	81.8	80.8	81	80.0
No-hit reliability	66.3	74.3	92.6	41.3
Predicted hit reliability	30.0	40.4	45.9	31.9
Predicted no-hit reliability	95.4	94.7	98.4	85.7
Overall reliability	68.6	75.4	91.8	51.2

SQG – sediment quality guideline

[1] The term "narrative intent" refers to the specific predictions associated with exposure to sediment chemical concentrations relative to SQGs. The concept of narrative intent is essential for understanding the comparison of sediment chemistry data with any particular measurement endpoint in terms of the potential risk posed by that sediment to the benthic community. In general, the low SQGs are sediment chemical concentrations below which adverse effects on benthic invertebrates are not expected to occur, and the high SQGs are concentrations above which adverse effects on benthic invertebrates are somewhat likely to occur.

4.0 EXCEEDANCE AREAS

The exceedance areas based on the high SQGs and the individual endpoints are presented on Maps 4-1 through 4-4. Conventional SQG exceedances are not mapped. For each endpoint, the chemicals necessary to maximize model performance are identified by different solid colors. Non-essential chemicals are identified as black areas. The exceedance acreages for the three endpoints that met the reliability criteria, based on necessary chemicals (excluding conventionals) were: *Chironomus* survival – 191 acres, *Chironomus* biomass – 128 acres, and *Hyalella* survival – 133 acres. The exceedance acreage for *Hyalella* biomass was 389 acres, but the *Hyalella* biomass SQGs had a false positive rate of nearly 40% and therefore failed to meet the reliability criteria. The maps also identify the non-exceedance areas based on the low SQGs and the individual endpoints and areas with uncertain risk determination (between low and high SQGs).

5.0 REFERENCES

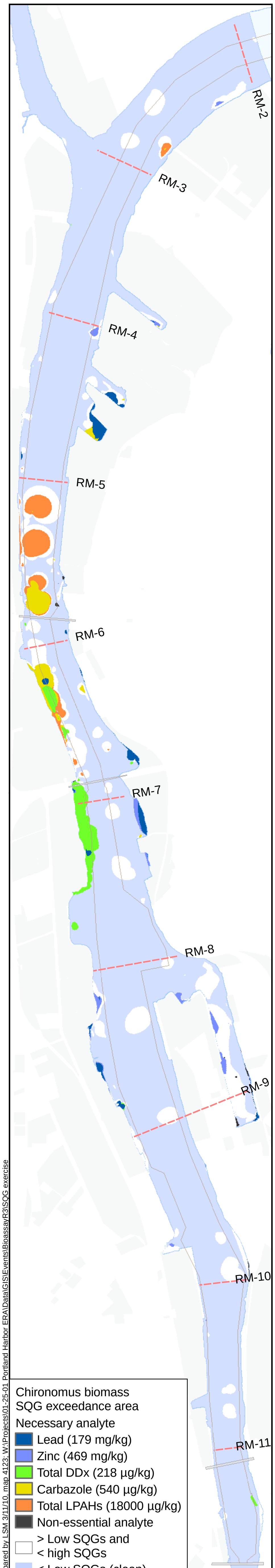
Avocet. 2003. Development of freshwater sediment quality values for use in Washington State. Phase II report: Development and recommendation of SQVs for freshwater sediments in Washington State. Publication No. 03-09-088. Prepared for Washington Department of Ecology. Avocet Consulting, Kenmore, WA.

EPA. 2010. EPA e-mail dated January 26, 2010 (Eric Blischke to John Toll), regarding pooling of endpoints for predictive models. Remedial Project Manager, US Environmental Protection Agency Region 10, Office of Environmental Cleanup, Portland, OR.

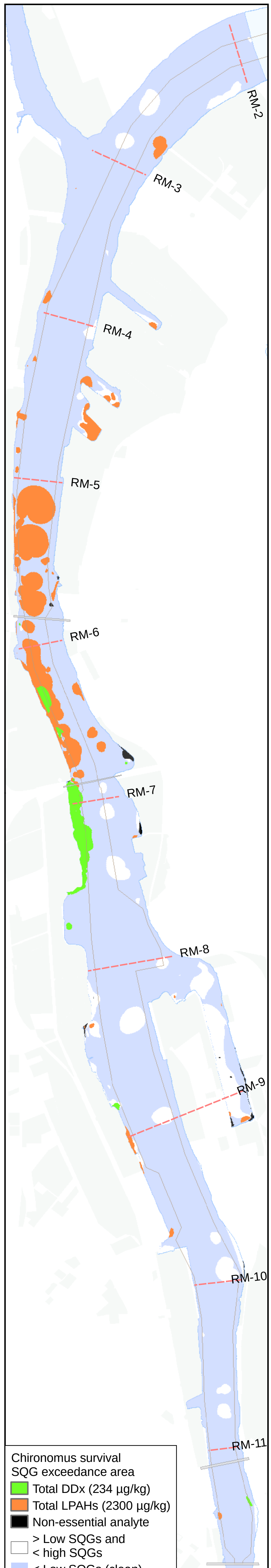
Windward. 2009a. Portland Harbor RI, Appendix G: Baseline ecological risk assessment. Draft. Prepared for the Lower Willamette Group. August 19, 2009. Windward Environmental LLC, Seattle, WA.

Windward. 2009b. Portland Harbor RI/FS. Technical memorandum: Benthic toxicity reanalysis technical memorandum. Draft. Prepared for the Lower Willamette Group. Windward Environmental LLC, Seattle, WA.

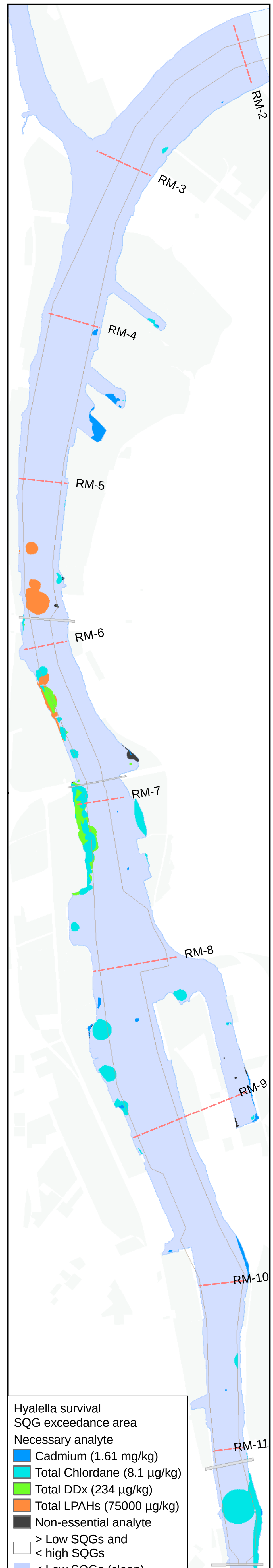
Prepared by LSM 3/11/10, map 4123; W:\Projects\01-25-01 Portland Harbor ERA\Data\GIS\Events\Bioassay\R3\SQG exercise



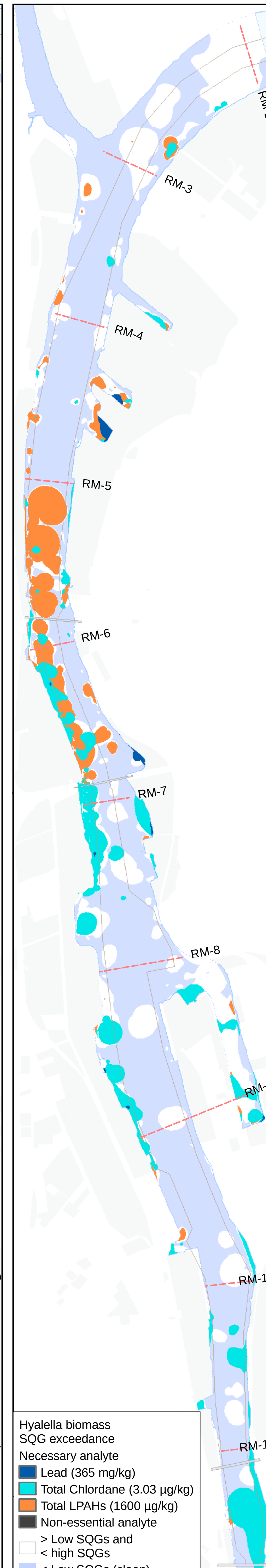
Map 4-1. Exceedance areas based on high site-specific SQGs and *Chironomus* biomass



Map 4-2. Exceedance areas based on high site-specific SQGs and *Chironomus* survival



Map 4-3. Exceedance areas based on high site-specific SQGs and *Hyalella* survival



Map 4-4. Exceedance areas based on high site-specific SQGs and *Hyalella* biomass

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0 1,000 2,000 3,000 4,000 Feet

N

FEATURE SOURCES:
SQG exceedance areas are based on the BERA dataset.
Transportation, Property, or Boundaries: Metro RLIS.
Channel & River miles: US Army Corps of Engineers.

Bridge
Upland Site (2008)
Navigation Channel
River Mile
River or slough